



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore


P. G. Program M.Sc. (Physics)

Semester - IV


Semester - IV											
Sub- ject Code	Cate- gory	Subject Name	Teaching and Evaluation Scheme								
			Theory			Practical		Th	T	P	Cre- dit
			End Sem University Exam	Two Term Exam	Tea- cher's Asses- ment	End Sem Unive- rsity Exam	Tea- cher's Asses- ment				
MSPH 401	DC	Plasma Physics -II	60	20	20	0	0	3	1	0	4


Course Objectives	<ol style="list-style-type: none"> <li>To develop the comprehensive understanding of laws of physics related to Plasma Physics – II and ability to apply them for laying the foundation for research and development.</li> <li>To work ethically as member as well as leader in a diverse team.</li> </ol>
Course Outcomes	<ol style="list-style-type: none"> <li>Student will be able to understand and solve the problems related to Plasma Physics - II.</li> <li>Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.</li> </ol>

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P	Practical	Teacher Assessment (Practical) shall be based on following components: Viva/ File/ Participation in Lab work (Given that no component shall be exceed 50% of Marks).

  
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P. G. Program M.Sc. (Physics)

## PLASMA PHYSICS - II

UNIT I: Kinetic theory of Plasma: Boltzman Equations, Equations of Kinetic Theory, Derivation of the Fluid Equations, The Meaning of Landau Damping, A Physical Derivation of Landau Damping, BGK and Van Kampen Modes, Experimental Verification.

UNIT II: Application of Plasma: Material processing, Bio-medical applications: Concept of Plasma Niddle, working and recent development, plasma sterilization, plasma surface modification of polymer, corona plasma: air and water disinfection, plasma based nanofacbrication, dielectric barrier discharge (DBD), plasma etching.


UNIT III: Diagnostics of Plasma: Single Probe Technique: Measurement of Electron Temperature and Electron ~~Temperature~~ <sup>Density</sup> of Plasma, Double Probe Technique: Measurement of Electron Temperature and Density of Plasma.

UNIT IV: Plasma Processing: DC-Discharges, Types of Low Pressure Discharges, Regions in a Glow Discharge, Processes in the Cathode Region, The Hollow Cathode Effect, Thermionic Emitters, The Negative Glow, The Positive Column, PACVD techniques.


UNIT V: Dusty and Quantum plasma: Laser Induced Plasma Medium, Strongly and Weakly coupled plasma, conditions for strongly coupled plasma, Quantum plasma, Dusty Plasma, Charging of dust particles, Forces on dust particles.


### References

1. J D Jackson: Classical electrodynamics ( Berkley, California, 1974).
2. J A Bittencourt: Fundamentals of Plasma Physics (Springer, III Edition).
3. F F Chen: Introduction to Plasma Physics (Plenum Press, III Print).
4. Introduction of dusty plasma, P. K. Shukla.
5. Quantum Plasma, F. Haas.

  
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## P. G. Program M.Sc. (Physics)


### Semester - IV


Subject Code	Category	Subject Name	Teaching and Evaluation Scheme								
			Theory			Practical		Th	T	P	Credit
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSPH402	DC	Material Science - II	60	20	20	0	0	3	1	0	4

Course Objectives	<ol style="list-style-type: none"> <li>1. To develop the comprehensive understanding of laws of physics related to Material Science – II and ability to apply them for laying the foundation for research and development.</li> <li>2. To work ethically as member as well as leader in a diverse team.</li> </ol>
Course Outcomes	<ol style="list-style-type: none"> <li>1. Student will be able to understand and solve the problems related to Material Science - II.</li> <li>2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.</li> </ol>

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## P. G. Program M.Sc. (Physics)

### MATERIAL SCIENCE-II

UNIT I: Mechanical properties of materials, Stress and strain behavior, Elastic properties of materials, Plastic deformation, tensile properties, compressive and shear deformation, hardness, creep, fracture, fatigue.

UNIT II : Magnetic materials: Magnetocrystalline anisotropy, Induced magnetic anisotropy, Magnetostriction, Magnetoelastic energy, Magnetoelastic coupling, Volume changes in magnetostriction, Villari effect, Wiedemann effect, Inverse Wiedemann effect, Matteucci effect,  $\Delta E$  effect, Barkhausen effect, Magnetization process, Technical magnetization, Magnetic after effect, Soft and hard magnetic materials, Ferrites their structure and uses..

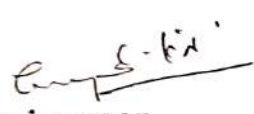
UNIT III: Corrosion: Mechanisms of localized corrosion, Oxidation, Thermodynamics oxidation, Oxidation resistance, Aqueous corrosion, Anodic dissolution, Corrosion prevention Development of environmentally-friendly protective coating systems


UNIT IV : Materials superconducting at liquid Helium temperatures, High-  $T_c$  metal oxides, Organic materials, Fullerenes, Borocarbides and Diborides, Preparation and characterization of superconducting materials, Crystal Structure, Phase Diagrams and Application of Low and High-  $T_c$  superconductors.


UNIT V: Liquid phase synthesis Precipitating Nanoparticles: (1) colloidal methods; (2) sol – gel processing; (3) water – oil microemulsions method; (4) hydrothermal synthesis; and (3) water – oil microemulsions method; (4) hydrothermal synthesis; and (5) polyol method.

#### References

1. Materials Science and Engineering, W. D. Callister, Jr. Wiley Eastern Limited, 1984.
2. Superconductivity Today, T. V. Ramakrishnan and C. N. R. Rao, Wiley Eastern Limited, 1992.

  
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			Theory			Practical		Th	T	P	Credit
			End Sem University Exam	Two Term Exam	Test Series Assessment	End Sem University Exam	Teacher Assessment				
MSPH403	DC	Laser Physics - II	60	20	20	0	0	3	1	0	4

Course Objectives	<ol style="list-style-type: none"> <li>1. To develop the comprehensive understanding of laws of physics related to Laser Physics - II and ability to apply them for laying the foundation for research and development.</li> <li>2. To work ethically as member as well as leader in a diverse team.</li> </ol>
Course Outcomes	<ol style="list-style-type: none"> <li>1. Student will be able to understand and solve the problems related to Laser Physics - II.</li> <li>2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.</li> </ol>

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## P. G. Program M.Sc. (Physics)

### LASER PHYSICS - II

**Unit I:** Multimode and pulse lasing Introduction, Q-Switching, Methods of Q Switching: Mechanical Q-Switching, Electro-Optic Q-Switching, Multimode Laser Oscillation, Phase-Locked Oscillators, Mode Locking, Amplitude-Modulated Mode Locking, Frequency-Modulated Mode Locking, Methods of Mode Locking.

**Unit II:** Optical Fibre Communication: Introduction, Ray Theory of Light Propagation through Optical Fibre, Acceptance Angle, Numerical Aperture, Types of Optical Fibre: SMF and MMF, Pulse Dispersion: Its Types and Impact on Information capacity, Graded Index Optical Fibre, Attenuation and Losses in Optical Fibre, Applications of Optical Fibre.

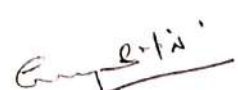
**Unit III:** Laser Material processing: Cutting, Welding, Drilling, Transformation Hardening, Melting and Rapid Solidification, Surface Alloying, Laser Cladding, Laser Glazing.

**Unit IV:** Atomic Energy: Uranium Isotope Separation (Enrichment of  $U_{235}$ ), Laser induced fusion, Defense Applications: Target Designation, Range finder, Guided missile and bomb, Anti missile system.


**Unit V:** Laser Doppler Velocity-Metry, Laser Application in Pollution Detection and Environmental Measurements, Medical Applications of Lasers: Eye Surgeries, Endoscopic Surgeries, Laser Skin treatments.

#### References

1. Introduction to Atomic and Molecular Spectroscopy by V.K.Jain
2. Lasers - Fundamentals and Applications, K. Thyagarajan, Springer.
3. Medical Applications of Laser, D.R. Vij and K. Mahesh, Springer.
4. Optical Electronics, M. Yariv.
5. Lasers and Non-linear Optics, B.B. Laud.
6. Industrial Applications of Lasers (Second Edition), John F. Ready, Elsevier

  
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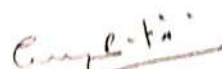
## P. G. Program M.Sc. (Physics)


### Semester - IV

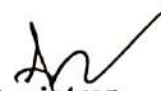
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			Theory			Practical		Th	T	P	Credit
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSPH404		Nano Physics - II	60	20	20	0	0	3	1	0	4

Course Objectives	<ol style="list-style-type: none"><li>1. To develop the comprehensive understanding of laws of physics related to Nano Physics – II and ability to apply them for laying the foundation for research and development.</li><li>2. To work ethically as member as well as leader in a diverse team.</li></ol>
Course Ourcomes	<ol style="list-style-type: none"><li>1. Student will be able to understand and solve the problems related to Nano Physics - II.</li><li>2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.</li></ol>

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## P. G. Program M.Sc. (Physics)

### Nano Physics – II

#### UNIT I: SEMICONDUCTOR NANOSTRUCTURES

Semiconductor fabrication techniques, Electronic structure and properties of semiconductor nanostructures, Principles and performance of semiconductor nanostructures based electronic and electro-optical devices.

#### UNIT II: MAGNETIC NANOSTRUCTURES

Magnetism in solids-magnetic domains, Nanomagnetic properties of materials-nanostructure relationships, Fabrication and properties of nanostructured magnets, Photoinduced magnetism and spintronics, Nanomagnetic probes, Electronic magneto transport and micro magnetic modeling.

#### UNIT III: NANOSENSORS AND ACTUATORS

Micro and nano electromechanical systems-fabrication process, choice of materials, calculations, performance of different nanostructures, advantages and limitations of various approaches. Applications-thermal, radiation, magnetic, chemical and mechanical nanosensors and micro actuators.

#### UNIT IV: MOLECULAR ELECTRONICS

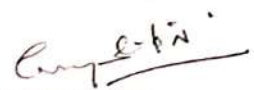
Conducting and semiconducting polymers-hybridization, conjugation and excitations. Molecular crystals. Organic electroluminescent displays-injection, transport, exciton formation and light emission. Influence of supramolecular order- excimers, H and J aggregates. Liquid crystal display.

#### UNIT V: INDUSTRIAL APPLICATIONS


Nanomaterials in bone substitutes & dentistry. Antimicrobial applications of nanomaterials. Food and cosmetic applications of nanomaterials. Application of nanomaterials in textiles, paints, catalysis, lubricants, fuel cells


#### References

- 1 J. Verdeyen, "Laser Electronics", II Edition, Prentice Hall, 1990.
- 2 C.W. Turner, T. Van Duzer, "Principles of Superconductive Devices and Circuits", 1981
- 3 Reynolds, M.Pomerant, "Electro responsive molecules and polymeric systems", Skotheim T. Marcel Dekker New York, 1991.

  
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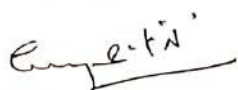
4 A. Yariv, "Principles of Optical Electronics", John Wiley, New York, 1984

### Semester - III


Subject Code	Category	Subject Name	Teaching and Evaluation Scheme								
			Theory			Practical		Th	T	P	Credit
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSPHQ05	DC	Digital Electronics	60	20	20	0	0	3	1	0	4


Course Objectives	<ol style="list-style-type: none"><li>1. To develop the comprehensive understanding of laws of physics related to Digital Electronics and ability to apply them for laying the foundation for research and development.</li><li>2. To work ethically as member as well as leader in a diverse team.</li></ol>
Course Ourcomes	<ol style="list-style-type: none"><li>1. Student will be able to understand and solve the problems related to Digital Electronics.</li><li>2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.</li></ol>

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## P. G. Program M.Sc. (Physics)

### DIGITAL ELECTRONICS

UNIT I: MOSFET, MESFET, HEMT and HBT: Structure, working, derivations of equations for I-V characteristics under different conditions, High frequency limits. Scaling of MOS devices and short channel FET.

UNIT II: Introduction to Logic families: TTL circuits: 7400 devices, TTL characteristics, TTL overview, Encoders and Decoders, DTL, RTL, MOS, CMOS, Classification of IC circuits: SSI, MSI, LSI, VLSI, ULSI.


UNIT III: Registers and counters: Buffer registers, Shift register, Ripple counters, Synchronous counters, Ring counters, other counters and Bus-organized computer. Flip-Flops: RS-latches, Level clocking, D-latches and flip-flops, JK master slave flip-flops.


UNIT IV: Oscillators: The phase shift oscillator, Wein bridge oscillator, LC-tunable oscillators, Multivibrator, Monostable and Astable. Simple-as-possible computer (SAP-1): Architecture, Instruction set, Programming, Fetch cycle, Execution cycle, Schematic diagram, Micro Programming.

UNIT V: Simple-as-possible computer-II (SAP-2): Bidirectional resistors, Architectures, Memory reference instructions, Registers instruction, Jump and call instructions, Logic instructions. Simple-as-possible computers (SAP-3): Programming model, Arithmetic instructions, Increments, decrements and multiples Logic instructions.

#### Reference

1. S M Sze: Semiconductor devices, (John Wiley & Sons)
2. M S Tyagi: Introduction to semiconductor materials and devices, (John Wiley & Sons)
3. M Sayer and A Mansingh: Measurement, instrumentation and experimental design in physics and engineering, (Prentice Hall of India, New Delhi)
4. Ajoy Ghatak and K Thyagarajan: Optical electronics, (Cambridge University Press)
5. J Millmann and C C Halkias: Integrated electronic: Analog and digital circuits and systems, (Tata Mcgraw-Hill Education, New Delhi)

  
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